of nines is up, and unity be added on the wheel on the right, all the nines are at once replaced by zeros and one is added to the figure on their left. The machine presents a *cliché* of figures, the basis for a stereotype plate; it will calculate and print a table to ten decimal places at the rate of about forty turns per minute. A two-horse power engine will be required to drive it to its full capacity.

An arithmometer, or multiplying machine, devised by Mr. Grant, was also shown with, for comparison, those of Thomas de Colmar and Baldwin, it being adapted to the same purposes as those, but constructed on the principle of the difference engine.

Prof. R. E. Rogers gave some facts of interest respecting the silver mines known as the Comstock Lode. In the deeper drifts the temperature is much higher than can be explained by the usual hypothesis of interior heat; it frequently reaches 150° F. Water trickling from the roofs of these drifts is so hot as to be almost scalding; workmen have to be protected from it by iron screens. An application of ice-water to the head at intervals is found necessary to the support of life. The heat is due to chemical action, principally to the decomposition of sulphide of silver deposits which takes place when water containing chloride of sodium reaches them. There is some saline material in the ore. It is a singular fact that while there appears to be no trace of copper in the ore, the washing from the quicksilver mills, which runs into a pond and there evaporates, leaves a deposit which is only 300 fine instead of 700, all the rest being copper. To extract the silver, this deposit is put into a cap-like receptacle of felt, and hot quicksilver is turned upon it, which strains through, and carries with it the copper and gold, leaving the silver. The next process is to separate the gold from the copper in the drippings. To effect this the combined substance is heated to fusion and allowed to cool, when the two metals segregate, and the gold cracks off the copper. Before the discovery of this process the "tailings" of the mills had no value; now they prove of considerable worth.

Prof. J. Lawrence Smith has been studying a crystalline product obtained from the graphite of meteoric iron, that proves soluble in ether and crystallises in acicular form. Wöhler and Roscoe have announced the discovery of a similar substance in carbonaceous meteorites. Prof. Smith finds it in carbon nodules in the very centre of large masses of meteoric iron. Wöhler and Roscoe regard it as a hydro-carbon; Prof. Smith gives reasons for considering it a sulpho-hydro-carbon.

In another communication Prof. J. Lawrence Smith described a pendulum designed to meet the wants of a cheap and efficient compensating arrangement for common clocks. Prof. Smith has taken advantage of the great expansibility of vulcanite under changes of temperature. His experiments, in common with those of others, prove that its coefficient of expansion is about that of mercury, between 0° and 212°. In applying this simple form of compensating pendulum to clocks, he states that it need not add more than twenty or thirty cents to the cost of the pendulum ordinarily in use. He has constructed one with more perfect means of adjustment, yet very simple in character, which he thinks can be attached to regulators and astronomical clocks. Prof. Smith is now engaged in investigating any possible change in the materials used that may interfere with the permanency of this instrument; from the nature of the subject it will take some time to arrive at the necessary results. In these experiments he is assisted by a very competent associate.

The following were the papers presented at the session, in addition to those already mentioned:—Contributions to Meteorology, by Prof. Elias Loomis; Exposition of several peculiar Astronomical Phenomena, by Prof. Stephen Alexander; Confirmation of same author's Theory of the Zodiacal Light, by the same; Composition of Schorlomite, by Prof. George A. Koenig; Modern System of Chemical Terminology, by Prof. R. E. Rogers; Steam Geysers of California, by the same; the Annular Nebula in Lyra, by Prof. Edward S. Holden. Prof. C. E. Dutton's paper on certain Igneous Rocks of Southern Utah was read by title only.

NOTES

PROF. HILDEBRAND HILDEBRANDSSON has published in the "Transactions" of the Royal Society of Sciences at Upsal, a clear and interesting account of a tornado which occurred near Hallsberg, in the province of Nerike, Sweden, on the 18th August, 1875. From the full details he gives it is evident that it closely resembled the tornadoes which have been described by the American meteorologists and the well-known tornado of Chatenay of 18th June, 1839, described by Peltier. Upwards of 1,000 large trees (*Pinus abies*), covering a space 1,000 feet in length by 500 feet in breadth, were totally destroyed, the greater number being torn up by the roots, whilst those about the margins of the path of the tornado were snapped across. On emerging from the forest, where its course had been directed to N.N.E., it turned in the direction of N.E., uprooting trees, overturning solid buildings, and carrying the *débris* of the ruins, in some cases, many miles from the scene of destruction. From the positions of objects thrown down, which are shown on a map, Dr. Hildebrandsson points out that in this instance the destructive force was compounded of two forces, one being directed towards the centre of the tornado and the other in the line of its course. The true theory of these terrible phenomena can only be arrived at by such carefully observed and collated facts as Dr. Hildebrandsson here presents us with; and much light would be thrown on this difficult question if barometric and thermometric observations were made within and near the district swept by the tornado.

YESTERDAY'S *Standard* contains a letter from the *Challenger* correspondent of the paper, dated Valparaiso, Nov. 19. Honolulu was left on August 11 and a call made at Hilo (Hawaii), when the crater of Kilauea was visited. On the 19th the *Challenger* left and made for Tahiti, soundings and dredgings being carried on by the way, the average depth being 2,800 fathoms, with a bottom of red clay. Oxide of manganese was brought up in large quantities, and "many things of great interest to the naturalist." Several excursions were made on the Island of Tahiti, and every opportunity was made use of to get acquainted with the productions, soil, climate, and inhabitants. Sail was again made on Oct. 2, and Juan Fernandez reached on Nov. 13, the average depth of the section being 2,160 fathoms. Hill and dale were tramped over by the naturalists and others during the two days' stay, and numerous specimens of birds and plants obtained. Valparaiso was reached on the 19th.

PART II. of the first volume of the new series of the "Transactions" of the Linnean Society, just published, contains a paper by Dr. J. D. Macdonald, on the external anatomy of *Tanais vittatris*, occurring with *Limnoria* and *Chelura terebrans* in excavated pier-wood, and another by Dr. M'Intosh, on *Valencinia armandi*, a new Nemertean. The first part contains Mr. Parker's memoir on the skull of the woodpeckers, one by the late Dr. R. v. Willemoes-Suhm on some Atlantic Crustacea from the *Challenger* Expedition, and one by Dr. Allman on the structure and systematic position of *Stephanoscyphus mirabilis*, the type of a new order of Hydrozoa.

SOME living specimens of the gigantic Tortoises of the Galapagos Islands, which were on their way to this country in H.M.S. *Repulse*, were lost, we regret to say, in a gale which did some damage to the ship and caused the death of two of the crew.

A NEW journal, *The Scientific Monthly*, devoted to the natural and kindred sciences, has been quite recently started at Toledo, Ohio, Mr. E. H. Fitch being the editor.

MESSRS. H. HOLT AND CO., New York, will publish during the month a work entitled "Life Histories of Animals, including Man," by Mr. A. S. Packard, jun. This work having appeared in parts in the *American Naturalist*, we can most certainly vouch for its excellence.

WE regret to have to announce the death of Mr. S. T. Davenport, well-known as an active and energetic officer of the Society of Arts. Mr. Davenport's connection with the Society had lasted for thirty-three years, and it was in great part to his unceasing and zealous efforts that the present prosperity of the institution is due. All who take an active interest in the Society of Arts will feel his loss severely.

An unfortunate difficulty at present prevents the Algerian Meteorological Service from sending telegrams daily to M. Leverrier for tabulation. It appears that the hour chosen at which to take the readings is seven in the morning instead of eight, the hour that has been adopted by all European nations. M. Leverrier could not by any means make use of the Algerian data in his daily weather maps. It is to be hoped that Algerian meteorologists will see the necessity of conforming to the rule universally adopted in European observatories. But some resistance is expected from those who have adopted the unusual hour for taking observations, as they contend that the readings taken then give a closer approximation to the mean state of weather. This assumption is hardly justifiable by facts: at any rate it cannot be considered as an objection to the taking of a reading at eight o'clock, and sending it by telegram to Europe.

At Christ Church, Oxford, there will be an election on Saturday, March 11, to at least two junior studentships in Physical Science, of the annual value of either 100*l.* or 85*l.*, tenable for five years.

The *Geographical Magazine* announces the discovery of a voluminous journal kept by Father Desideri, who resided and travelled in Thibet in the early part of last century.

The Dutch Government have adopted a plan for draining the Zuyder Zee at an expense of nearly 10,000,000*l.* The area to be drained is estimated at 759 square miles.

The Bureau of Agriculture of the United States Centennial Commission (not the United States Agricultural Department) has lately issued a circular, which announces that it is proposed to have an exhibition of living fish of many varieties, for which purpose plans have been prepared for the erection of twenty-five tanks of approved construction, ranging from two to twenty feet in length and from one to six feet in depth, the whole containing about six thousand cubic feet of water. The cost of these aquaria is estimated at $6,000. The Bureau of Agriculture desire to render this enterprise in a measure self-supporting, and the circular invites those interested in the subject to purchase one or more ten-dollar shares of the Centennial stock, with the understanding that the proceeds, although going into the general fund, are to be considered as contributed to the fish exhibition.

Mr. G. S. Boulger, F.G.S., has been appointed Professor of Natural History in the Agricultural College, Cirencester.

The North-German *Allgemeine Zeitung* of Jan. 7 publishes a long article on the Hamburg Naval Observatory. It appears that this establishment commences operations to-day, and professes to include the several branches of scientific seamanship. The establishment is said to have been fitted up according to the most improved method, regardless of cost.

Two Parisian daily papers, the *Bien Public* and the *Opinion Nationale*, publish daily the weather maps designed by M. Leverrier for the international meteorological service.

The list of the members of the French Bureau des Longitudes has been published. Besides the ordinary members appointed either by the Bureau or by the Academy of Sciences, the War Office, and the Marine Department, a number of correspondents have been appointed, including M. Stephan at Marseilles, M. Tisserand at Toulouse, M. Marie Davy at Montsouris (Paris), Admiral La Ronciere le Nourry, &c.

The meteorological *Annuaire* of the Montsouris Physical Observatory has been published by M. Marie Davy. Excellent woodcuts show the details of the several anemometers and magnetometers used by the institution. The results of all the readings taken in the preceding year have been carefully tabulated. The maximum registered velocity of the wind was 80 kilometres an hour, and the maximum pressure 47 kilogrammes per square metre.

M. Leverrier may come to London in order to be present at the distribution of medals by the Royal Astronomical Society. The printing of his tables for Saturn is progressing favourably. The verifications made have been satisfactory.

A very useful and complete summary of the geographical progress of 1875 will be found in *The Colonies* for January 8. The same well-conducted paper has commenced a series of "Ethnographical sketches of the various aborignal or indigenous races inhabiting countries and islands that are becoming daily more known to us through the rapid development of trade and commerce," but whose inhabitants are disappearing or being greatly changed. The first sketch, under the head of Pacific Islands, is of the Hawaiians or Sandwich Islanders.

The Italian Minister of Public Instruction has made a grant of 1,000*l.* for the scientific expedition to Central Africa (see Nature, vol. xiii. p. 155).

A pithy article in the Hastings and St. Leonard's *News* of the 7th inst. calls attention to the scientific destitution of that favourite watering-place. There seems at one time to have been an apology for a museum, but its dusty contents have long ago been scattered. So far as we know, Hastings has not even a local scientific society or field-club, although the district around, including the sea and its shore, would furnish a fertile field for such an association. Indeed, with the exception of a science and art class, Hastings seems to be quite destitute of any means of fostering a love of science or of scientific pursuits and recreations among its people. Surely there are a few men in the town who know the value of science; at all events, we hope the forcible remarks in the *News* will have the effect of rousing the people to bring their town abreast of its neighbours in the matter both of a well-furnished museum and a scientific society and field-club.

We take the following from the *Geographical Magazine*:— Announcement was made at a recent meeting of the Society for the Encouragement of Commerce and Industry, in St. Petersburg, that a person who does not wish his name to be known has offered a sum of 25,000 rubles (3,125*l.*) towards a scientific expedition to explore a commercial route from Northern Russia to Behring's Straits. Prof. Nordenskiold has agreed to accept the leadership of the expedition, which will start next summer. Subscriptions to the amount of 26,000 rubles (3,250*l.*) have also been received towards the cost of another expedition composed of two vessels, which shall last three years, and shall explore the Gulf of Obi as well as the sea-route between Archangel and the great rivers of Siberia. The command of this one will be entrusted to Capt. Wiggins, of Sunderland, who has, however, stipulated for full liberty of action in unforeseen circumstances, and who has remained in St. Petersburg, waiting for the replies of the Mayors of Irkutzk, Krasnoyarsk, Tobolsk, Tiumen, Tomsk, and Ekaterinburg, who have been invited by telegraph to co-operate in forwarding the enterprise. A reply has since been received from a proprietor of gold mines at Krasnoyarsk contributing 500*l.* to the expenses of the undertaking.

"From Vineyard to Decanter" (Stanford), the second edition of which has come to hand, is "a book about sherry." We would recommend it to all of our readers who love "a good glass" of that favourite British beverage. It gives a clear account of the processes through which the wine goes in all its stages, and the conclusion of the whole matter seems to be that if you wish to drink good sherry you must make up your mind to pay a good price for it.

THE *Revue Scientifique* announces the death of the naturalist M. Pictet.

THE *Cologne Gazette* states that Herr Heuglin, the African traveller, has declined the offer of the Khedive to take the command of the troops sent to Abyssinia, in place of the late Munzinger Pasha, but is organising an Abyssinian exploration for scientific purposes.

DR. VON RICHTHOFEN, the well-known traveller and geographer, has been appointed Professor of Geography at the University of Bonn. He is still occupied at Berlin with the editing of his great work on China.

THE additions to the Zoological Society's Gardens during the past week include a Le Vaillant's Cynictis (*Cynictis penicillata*) from South Africa, presented by the Viscount Maudeville; a Hooper Swan (*Cygnus ferus*), European, presented by Mr. Montague Kingsford; a Weeper Capuchin (*Cebus capucinus*) from Brazil, presented by Mr. August Kettner; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mr. T. J. Dunn; two Darwin's Pucras (*Pucrasia Darwini*) from China, purchased.

SCIENTIFIC SERIALS

Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie, Nov. 15, 1875.—Dr. Billwiller, of Zürich, contributes an article on a local occurrence of the northerly "Föhn." It was formerly believed that the Föhn came from the Sahara Desert, whence it derived its warmth and dryness, but Hann showed a few years ago that, according to known physical laws, descending air becomes warmer and drier, that winds of the Föhn kind are not confined to the Alps but occur in other mountainous regions, and that the southern slopes of the Alps have a north wind, which is the exact counterpart of that called the Föhn. A mass of observations made in Switzerland have since proved the correctness of his theory. Herr Billwiller, from the data he has as yet examined, finds that isolated Föhn winds prevail only when a broad current flows over the whole Alps in the same direction, ascending on one side and descending on the other. But there are cases in which no perceptible upward movement can be traced on one side, and yet on the other the Föhn descends into the valleys from above. A difference of density, often great, is the cause of this. The lower strata being obstructed the outflow of air necessary to restore equilibrium comes from above. The merely local Föhn blows strongly down a valley, but on reaching the colder air of the plain mixes with it and quickly comes to rest. Tables are given showing meteorological conditions in particular cases.—The next article, written by Dr. Wild, and quoted here from the Annual Report of the Imperial Observatory at St. Petersburg, is a review of the work of the Meteorological Congresses of 1873 and 1874. Perhaps the most important result of these congresses will be the general use of more trustworthy instruments by official and private observers. The following advantages have already been gained: an international system of ciphers for telegraphic despatches throughout nearly the whole of Europe; an international form of publication in the following countries: Norway, Sweden, Denmark, Russia, Austria, Switzerland, Italy, and part of Germany; and lastly, the establishment in many States of central institutions. We shall thus obtain better, more uniform, and more accessible data as a consequence of the late congresses.

SOCIETIES AND ACADEMIES

London

Royal Society, Jan. 6.—On the refraction of sound by the atmosphere, by Prof. Osborne Reynolds, Owens College, Manchester. Communicated by Prof. Stokes, Sec. R.S.

This paper may be said to consist of two divisions. The first contains an account of some experiments and observations undertaken with a view to ascertain how far the refraction of sound caused by the upward variation of temperature may be the cause of the difference in the distances to which sounds of the same intensity may be heard at different times.

Some rockets, capable of rising 1,000 feet, and then exploding a cartridge containing 12 oz. of powder, having been procured, an effort was made to compare the distance at which the rockets could be heard with that at which a gun, firing ¼ lb. of powder and making a louder report than the rockets, could be heard under the same conditions of the atmosphere. In the first instance the rockets and the gun were fired from a spot in Suffolk, around which the country is tolerably flat, observers being stationed at different distances. Owing, however, to the effect of the wind and the time required for the observers to proceed to the distant stations, these experiments were not successful in establishing the comparative merits of the gun and the rockets. They were, however, important as showing that on hot calm days in July the reports of the rockets never failed to be distinctly audible at distances of four and five miles, although the sun at the time was shining with full force on the ground, and rendering the air near the surface so heterogeneous that distant objects seen through it appeared to wave about and twinkle.

The next attempt was made during a cruise on the east coast. After three weeks cold and windy weather, the 19th of August was a fine day, and some experiments were made in Lynn Deeps, which revealed a very extraordinary state of the atmosphere as regards the transmission of sound. A party rowed away from the yacht in one of her boats, it having been arranged beforehand that either a rocket or a large pistol was to be fired from the yacht when signalled for; also that when those on the yacht heard those in the boat call they should answer. The boat proceeded to a distance of five miles, until those on the yacht had completely lost sight of it; but all the time the calls from the boat were distinctly heard by those on the yacht, although after they had lost sight of the boat they ceased to answer the calls. On the boat also not only were the reports of the pistol and rockets distinctly heard, but every answer from the yacht was heard plainly. The last came after an interval of thirty-five seconds, which gave the distance 3½ miles. Nor was this all; but guns, and on one occasion the barking of a dog, on the shore eight miles distant, were distinctly heard, as were also the paddles of a steamer fifteen miles distant.

The day was perfectly calm, there was no wind, the sky was quite clear, and the sun shining with great power—conditions which have been described as most favourable to the stoppage of the sound by the heterogeneity of the atmosphere, and which may also be described as most favourable for great upward refraction. On this day, however, it was observed that all the time distant objects *loomed* considerably, *i.e.*, appeared lifted. This showed that the air was colder near the surface of the sea than it was above. It is to this circumstance that the extraordinary distances to which sounds were heard on this day is supposed to be due. The diminution in the temperature of the air being downwards, the sound, instead of being lifted as it usually is, was brought down, and thus intensified at the surface of the water, which, being perfectly smooth, was thus converted into a sort of whispering-gallery.

The report of the pistol and the sounds of the voice were attended with echoes, but not so the reports of the rockets; and it is suggested that these so-called echoes may be found only to attend sounds having a greater intensity in one direction than in another.

The second part of the paper refers to a phenomenon noticed by Arago in his report of the celebrated experiments on the velocity of sound made on the nights of the 21st and 22nd of June, 1822.

It was then found that, although the guns fired at Montlhery could be distinctly heard at Villejuif (eleven miles distant), those fired at Villejuif could not be heard at Montlhery without great attention, and at times (particularly on the second night) they were not heard at all; although on both nights the wind was blowing from Villejuif to Montlhery, the speed of the wind, which was very light, being about 1 foot per second. No explanation of this phenomenon was offered by the observers, although it was much commented on. And on the second night the gun at Villejuif, which on the previous night had been pointed upward, was brought down in the hope that this might improve its audibility (this step was, however, found to render matters worse than before).

From this lowering of the gun at Villejuif it seemed as though there was probably some difference in the conditions under which the guns at the two stations were placed, as if that at Villejuif was fired from a level, while that at Montlhery might be fired over a parapet. An inspection of the district confirmed this view; for Villejuif is on a low, flat hill, while Montlhery is on the top of a steep cone; and not only is it 80 feet above Villejuif, but it is surmounted by the mound of an old castle, which